TABLE 3.—*The ice conditions on the Great Lakes during the winter of 1907–8*—Continued.

LAKE ERIE—*Continued.*

Stations.	Ice first formed.	Maximum thickness.		Ice disappeared.	Remarks.
		Inches.	Date.		
Cleveland, Ohio	Jan. 14, 1908	9.0	Feb. 20, 1908	Mar. 15, 1908	The lake was covered with ice in all directions from February 8 to 25. The closed season was one of the shortest during the last ten years; in both lake and harbor the thickness of ice fell much below the average for that period. The date of formation of ice in the harbor was the latest in the last ten years.
Fairport, Ohio	Dec. 11, 1907	14.0	Feb. 20, 1908	Mar. 7, 1908	
Ashtabula, Ohio	Jan. 15, 1908	11.0	Feb. —, 1908	Mar. 30, 1908	
Conneaut, Ohio	Dec. 2, 1907	14.0	Feb. 10, 1908	Apr. 1, 1908	Ice fields first appeared in the lake off this port January 9, 1908. There was more ice in the lake this year than last.
Erie, Pa	Dec. 18, 1907	12.5	Feb. 10, 1908	Apr. —, 1908	The harbor was partially frozen over from December 18 to 30, and again during the second week in January. Ice covered the lake as far as the eye could reach from February 3 to 26, after which it was broken up and drifted with the wind until early in April.
Dunkirk, N. Y	Jan. 12, 1908	9.0	Feb. 10, 1908	Apr. 17, 1908	
Buffalo, N. Y	Dec. 20, 1907	13.5	Feb. 10, 1908	May 9, 1908	The entire harbor was not frozen over till January 24, when most of this end of the lake was covered with thin floating ice for the first time. Solid ice first extended up the lake beyond vision on January 31, and it did not begin to break up till March 28. This end of the lake was practically covered with heavy ice fields from that date till May 1, after which the ice rapidly disappeared from the lake. The harbor was free of ice after March 23.
LAKE ONTARIO.					
Fort Niagara, N. Y	Jan. 24, 1908	12.0	Feb. 4, 1908	Apr. 10, 1908	
Charlotte, N. Y	Jan. 29, 1908	2.0	Feb. 3, 1908	Mar. —, 1908	But one small field of ice in the lake was observed after February 3, 1908.
Sodus Point, N. Y	Jan. 8, 1908	18.0	Feb. 20, 1908	Mar. 28, 1908	Only a few small ice fields observed in the lake off this port during the past winter.
North Fair Haven, N. Y	Jan. 4, 1908	16.0	Feb. 5, 1908	Mar. 28, 1908	There was very little ice in the lake at any time during the past winter, much less than usual.
Oswego, N. Y	Dec. 16, 1907	12.0	Mar. 2, 1908	Mar. 15, 1908	There was much less field ice during the past winter than usual, but considerable ice formed on the shore.
Sacketts Harbor, N. Y	Jan. 9, 1908	16.0	Mar. 10, 1908	Apr. 2, 1908	
Cape Vincent, N. Y	Jan. 15, 1908	15.0	Mar. 15, 1908	Apr. 10, 1908	
Ogdensburg, N. Y	Dec. 28, 1907	18.0	Feb. 15, 1908	Apr. 7, 1908	The ice was very slow to form in the river this winter. A heavy fall of snow prevented its freezing to any considerable thickness until in February.

EARLY METEOROLOGY AT HARVARD COLLEGE.

By B. M. VARNEY, Assistant in Meteorology. Dated Cambridge, Mass., June 6, 1908.

In the course of some work among the stacks and manuscripts of the Harvard College Library, the writer recently happened upon material relating to the early connection of Harvard with meteorology. The various writings which concern the early stages of this science in America seem worth presenting in outline, for their interest to present-day meteorologists.

The first definite mention of the subject, as directly concerning Harvard College, is to be found in a printed announcement of lectures by Isaac Greenwood, the first Hollis Professor of Mathematics and Natural Philosophy. His term of service extended from 1727[1] to 1738, inclusive. The lectures seem not to have been regularly presented to his classes, but were apparently delivered in public, under conditions which will be mentioned presently. They were accompanied by "a great variety of curious experiments," and numbered twelve in all. They were divided into three "articles." The last was entitled "Of the True Causes of the Principal Phænomena in Nature, by Means of the Newtonian Laws of Matter and Motion." The subjects of this third article occupied the last three lectures. First came "A View of the World Around Us Subject to these Laws;" then "An Enumeration of the Phænomena of the Solar System," with the inevitable "curious experiments;" then "Gravity * * * Fluids, Hydrostatical and Pneumatical;" and lastly, "Of the Action of the Sun and Moon Upon the Atmosphere and bodies contained therein * * * where with many other curiosities a particular consideration will be taken of Dr. Desagulier's late Theory of the Rise of Vapors and formation of clouds and Meteors, with his experiments concerning them."

The word *curiosity* is a good comment on the mental attitude toward science of the public of the early seventeen hundreds, and of the early nineteen hundreds as well. Greenwood's little syllabus is arranged in a fashion well calculated to appeal to prospective audiences, for it states not only that "the apparatus is compleat for the experiments," but that it "will be enlarged with new machines and models of some curious engines, lately invented, if there be a full course." At the end, however, comes this announcement: "Every subscriber to pay four pounds, one at the time of subscription, and the remainder on the third and sixth days of the course."

What lectures on meteorology Professor Greenwood gave before his regular classes does not appear; they probably embodied some or all of the "curious experiments," and probably occupied a very minor part of the whole course. This is quite to be expected; meteorology as such was almost unthought of in America at the time, and was everywhere treated as a small part of the general course on natural philosophy.

Greenwood's official successor was John Winthrop, who held his position from 1738 to 1779. During this long period of service he gave a series of lectures which must have attracted many students. The record of these is contained in a little leather-bound, closely-written note book, entitled "Summary of a Course of Experimental and Philosophical Lectures." The course hardly occupied the time of what is now called at Harvard a half-course, for it extended only from March 10 (the first year being 1746) to June 16. Winthrop's treatment of meteorology was considerably more elaborate than that of his predecessor; it included the atmosphere, the thermometer, and the barometer and its uses even to the measurement of altitudes. It is interesting to note the careful correlation he made between weather changes and the variations in the height of the mercury-column, the prevalence of high pressures when the wind is northerly, and the greater variation of pressures in winter. He gave a maximum variation for this country of two inches, from 28.75 to 30.75 inches.

Near the close of the twenty-fifth lecture, he writes thus: "Thermometers are of different kinds; as of air which forces water up into a tube by its elasticity, but it will never answer the (purpose?) because it's a barometer and thermometer too. They have till lately been made of spirits of wine; but those made of mercury are esteemed the best because they are most easily affected." Winthrop kept a personal meteorological record for about twenty years, beginning with 1742. The thermometer was "of Mr. Hawksbee's make", filled with spirits of wine. Its scale, an astonishing contrivance, began above at 0°, had its freezing point below at 65° and extended down

[1] This was the year of the death of Sir Isaac Newton.—*C. A.*

to 100° just above the bulb.[2] This arrangement caused Professor Winthrop some thought, for he wrote in his manuscript, "How it was adjusted in London I know not, but it appears to me yt ye freezing point is marked considerably too high, for having plunged ye bulb into a vessel of snow, I found ye spirits fell down to 76.5° and then rested." The Hawksbee scale proving a source of annoyance, the observations from 1759 to 1763 were taken on a Fahrenheit thermometer, with comparative readings from the other. Both thermometers were on the north side of his house—an attempt to insure the uniformity of exposure now attained by the shelter.

It is a noticeable fact that down to the close of John Winthrop's activity, meteorology at Harvard had been purely a matter of tabulation of observed temperatures and observed rainfalls, with little deduction or speculation therefrom. In his lectures, to be sure, Winthrop generalizes somewhat on the evident relation of pressure to weather; but speculative matter there is none.

In 1780 Samuel Williams became the Hollis Professor of Mathematics and Natural Philosophy. In that year began the development of a new "scientific spirit" at Harvard. There is preserved abundant manuscript evidence of Professor Williams's broad and broadening activity. "Lectures on Air," "Lecture on Magnetism," "The Motion and Phenomena of Heat as it Respects the Earth," and, most interesting of all from our meteorological side, "Change of Climate in North America," "Change of Climate in Europe," and "Causes of Changes in Climate"—these titles tell their own story. Mr. Williams was a member of the Meteorological Society of the Palatinate [Germany], of the Philosophical Society in Philadelphia, and of the Academy of Arts and Sciences in Massachusetts. In his manuscripts, from which these notes are taken, he informs us that "it was the author's duty to adapt them" (the lectures) "to the use of students in philosophy and astronomy." The lectures covered many other than meteorological and kindred subjects. Comets, the aurora borealis, and earthquakes occupied a prominent place. Seven whole lectures treated of the return, heat, atmospheres, tails, and effects of comets; one lecture treated of the aurora, the New England earthquakes occupied two, and one treated of the great darkness of May 19, 1780.

Among the manuscripts are preserved many which show the personal side of Professor Williams's activities. They include all sorts of observations of temperature and weather. A little hand-ruled, cardboard-covered pamphlet with "Meteorological Observations for 1790 and 1791" written on the cover, gives a very full thrice daily record for temperature, wind direction, and state of the sky, with a "remarks" column. The wind direction is given as, for instance, "N. W. 2." What the 2 stands for is uncertain, tho it would seem that it was one member of some scale of velocities.[3] The state of the sky is ingeniously shown by three signs: ⊙, ⊂—, ==, for clear, partly cloudy, and overcast, respectively. Comparative temperatures of various kinds seem to have interested Williams fully as much as weather observations properly so-called. From June 22, 1785, to September 26, 1786, he took observations of the "heat of the water in wells," and gave for comparative data the place, time, situation, soil, "depth of the well by estimation," and "natural heat of the atmosphere." Some of these observations were evidently taken on a trip to New Haven and Williamstown, for notes are given on a string of wells from Cambridge to New Haven and from Hartford to Williamstown. Similar observations were made in and around Cambridge on the temperature of spring water as compared with the temperature of the atmosphere.

There is nothing to indicate that Williams took systematic precipitation observations, except that we find one loose sheet, much browned with age, on which is written: "Dimensions of the Ombrometer. Length of one side, 14.15 inches. Area, or contents of the Tunnel, 200.2225 inches. *Measures.* With a tube of 20 cubic inches." "1. Tube 10 times full amounts to 1 in. in altitude," and so on down to "tube 2 tenths of an inch full is 0.001."

Most interesting of all the manuscript tables, however, as showing what systematic work had been done before Williams's time, is a little table headed "Observations of the Extreme Degrees of Heat and Cold in the Commonwealth of Massachusetts, made by Fahrenheit Thermometer." They extend from January 12, 1752, to December 12, 1786, and give the year, month, day, hour, and place (all in eastern Massachusetts), with short notes on the exposure of the thermometer and on the observer. At the end of the table appears the following:

> December 25, 1786. The above are all the observations of extreme heat and cold which I can collect. For many years after the first settlement of the country, thermometers were not in use. The earliest observations I can find were those of the late Dr. Winthrop, inserted in the Massachusetts Gazette, Jan. 31, 1765. They begin with the year 1752.

Aside from temperature observations of various kinds, Professor Williams carried on a series of experiments on evaporation on the Merrimac River.

Of the meteorological work done by Professor Williams's successor, Samuel Webber, very little is recorded. He took barometric observations from January, 1790, to June, 1807, using an instrument furnished by the Meteorological Society of the Palatinate (whose headquarters were at Mannheim) till 1802, and after that time one made by Champney, of London. In May, 1806, Webber resigned the Hollis professorship and became president of the university, a post which he held till the middle of July, 1810. There is no evidence that he taught meteorology during his professorship, tho he probably included a brief mention of it in his lectures.

The last Hollis professor of the earlier period of whose connection with meteorological teaching there is anything like a complete record is John Farrar, Webber's successor. The science had by this time advanced far beyond its position in Williams's day. This advance is reflected not only in Farrar's writings, but in the fulness and care with which he recorded and studied all sorts of observations. During his long service (1807–1836) Farrar gave a "Course in Natural Philosophy." Under the part headed "Astronomy, Section Atmosphere and Its Effects" he notes the blackness of the sky as seen from high mountains and balloons. To the atmosphere he ascribes the diffusion of sunlight. "If there were no atmosphere," he says, "the sun, even when near the horizon, would shine with the whole of its light, and instantly upon its setting we should find ourselves in profound darkness." The course in natural philosophy succeeded a course in pure mathematics, and began with the second term of the junior year. It was continued in the senior year, and came (as the president's report for 1828–29 states) "every morning in the week immediately after prayers." Professor Farrar spent the academic year 1831–32 in Europe for his health. The change evidently was not as beneficial as could be desired, for the president's report for 1832–33 says that he "was excused from all except lecture work." His decline in health is not to be wondered at. Besides his teaching and immense amount of private observation and study, he found time to make translations of the best French text-books of mathematics and natural philosophy. "Their wide introduction to American colleges," said Professor Lovering at a meeting of the American Academy of Arts and

[2] Delisle, at St. Petersburg, 1726–1736, used mercurial thermometers on which 0° was boiling point of water and 150° the freezing point. He thus avoided the frequent negative readings that occur in Russia. Possibly Hawksbee had the same intentions as regards New England winter temperatures, and put his 0° at the boiling point of alcohol. Up to 1750 each maker felt at liberty to modify the thermometer after his own notions.—*C. A.*

[3] The Mannheim scale of winds was 0, 1, 2, 3, 4.—*C. A.*

Sciences, in 1853, was "not the least important of the services rendered to science by Mr. Farrar."

In an elementary treatise on mechanics Professor Farrar devotes a considerable section to the barometer. At the end of it, in a series of "Notes," he gives additional information on the history of the instrument. Reference is made to the early belief that humid air was heavier than dry air and hence that the barometer ought to stand higher in rainy weather than in clear, and the fallacy of this belief is pointed out. Of the diurnal variation of the barometer in the Tropics he says: "Neither the wind, nor rain, nor fair weather, nor tempest disturb the perfect regularity of these oscillations."

Mention has already been made of Professor Farrar's personal observations. They were great in variety and astonishing in completeness. We can merely mention the principal points of interest about them here. His barometer was made by W. and S. Jones, London, and was provided with a floating gage and a scale of correction, and was graduated into English inches and hundredths. His temperature observations extended thru the years 1807–1812, 1813, 1816, and 1817. They were abstracted from time to time, together with Professor Webber's for the years 1790–1807, in the American Almanac. During the years 1800–1806 he made hygrometrical observations with a Daniels hygrometer, tabulating the results under "greatest," "mean," and "least," by months. His observations of a great storm which occurred in New England September 23, 1815, are very detailed as to wind direction and velocity, barometer, state of the sky, etc.

With the close of Mr. Farrar's activity as professor of mathematics and natural philosophy, in 1836, the record of the connection of Harvard with meteorology temporarily ceases. Not until thirty-four years later comes the first official mention of meteorology in the university, in the president's report for 1870–71. In that year, with the meteorological lectures of Professor Whitney, began the second and fuller development of the science at Cambridge. An account of this second period, which is seemingly quite independent of the earlier, would deal with the work of Whitney, Pettee, Shaler, Davis, Ward, Rotch, and others, also with the establishment of the Harvard College Observatory and of the Blue Hill Meteorological Observatory; but it would greatly exceed the limits set for this paper.

THE METEOR OF OCTOBER 5, 1907, OVER NEW JERSEY AND PENNSYLVANIA.

By Prof. HENRY A. PECK. Dated Syracuse, N. Y., May 28, 1908.

Saturday evening, October 5, 1907, at 9:55 p. m., eastern time, a very large meteor was seen to pass from a position over the ocean east of the New Jersey coast to the vicinity of Warren, Ohio. It was quite widely noticed in the daily press of the principal cities along its route, including New York, Philadelphia, Baltimore, and Washington. The steamer *Castilian Prince*, plying between Fernandina and New York, observed the phenomenon while coming up the New Jersey coast between Seagirt and Barnegat. Aside from the widely extended press notices, reports have been received from the following, the greater share being in response to a postal-card canvass conducted by the Central Office of the Weather Bureau:

ONTARIO, CANADA.

Deshler Welch, Niagara on the Lake.

NEW YORK.

Fred G. Wyman, Binghamton.
Louis Renault, Brooklyn.
Henry A. Morris, Brooklyn.
E. J. McLaughlin, Brooklyn.
William H. Orr, Buffalo.
Frank W. Cheney, Jamestown.
A. J. Lannes, Jamestown.
Frank J. Nash, Leroy.
Frank W. Ball, Leroy.
Maurice C. Ashley, Middletown.
William C. Thomas, New York.
Charles W. Hall, North Tonawanda.
E. Russell Davis, Norwich.
T. C. Sweet, Phœnix.
Paul A. Mackey, Poughkeepsie.
H. W. Nelson, jr., Poughkeepsie.
Robert Dunk, Scriba.
H. C. Townsend, Wappingers Falls.

NEW JERSEY.

F. C. Pierce, Imlaystown.
Bert Stiff, Jersey City.
William P. Bowne, Lambertville.
Mrs. John H. Brown, Long Branch.
Lewis B. Holt, Ocean Grove.
D. W. Smith, Phillipsburg.
P. Hardcastle, Somerville.
Dr. Franklin Chattin, Trenton.

PENNSYLVANIA.

Arthur B. Cornell, Allegheny.
Isaac D. Kreiss, Benjamin.
R. B. Headlee, Brock.
Mrs. C Swenson, Ambridge.
A. M. Orr, Greenville.
George H. Sprenkle, Hanover.
E. R. Demain, Harrisburg.
M. L Heisler, Harrisburg.
John Larimer, Leetsdale.
T. H. Weagley, M. D., Marion.
A. F. See, Meadville.
Thomas L. Becker, Newmanstown.
M. T Bretz, Newport.
Clyde Swartz, Nittany.
J. F Blair, Orrstown.
C. F. Clement, Philadelphia.
U. J. Stewart, Pine Bank.
Harry E. Adams, Pittsburg.
S. E. Smith, Reading.
J. G. Apple, Saegerstown.
Mrs. Alfred McElwain, Scenery Hill.
Benjamin W. Collins, Swarthmore.
George Q. Weaver, Talmage.
George Kralt, jr., Washington.
Dr. I. C. Green, West Chester.
Hannah M. Warrington, West Chester.
Mrs. Mabel A. Conrad, Woodhill.

DELAWARE.

H. S. Gray, Clayton.

MARYLAND.

Harry B. Mason, Denton.
Dr. Winfred T. Morrison, Elkton.
Henry Trail, Frederick.
E. A. McCulloch, Glencoe.
Joseph Plummer, Jewell.
James R. Stewart, Princess Anne.
C. W E. Treadwell, Towson.

DISTRICT OF COLUMBIA.

Thurbert H. Conklin, Washington.
Miss Kate S. Curry, Washington.
W. W. Saunders, Washington.
Herbert C. Hunter, Washington.

VIRGINIA.

H. H. Fox, Ashland.
Mrs. E. B. Kneiple, Broadway.
Lizzie M. Heatwole, Dale Enterprise.
S. E. Fletcher, Glenallen.
Samuel Brunk, Harrisonburg.
Frank Luke, Warrenton.

WEST VIRGINIA.

J. W. Thompson, Elkins.
R. F. Adams, Huntington.

OHIO.

John A. Wentz, Canton.
Edwin Vogelgesang, Canton.
Charles F. Stokey, Canton.
S. M. Painter, Fredericktown.
B. W. Adair, Leesville.
H. R. McClintock, Summerfield.
Prof. T. H. Sonnedecker, Tiffin.

The accompanying table, in which localities have been arranged by States and in order of longitude from east to west, presents notes as to the physical appearance of the meteor. No attempt has been made to harmonize discrepancies, but as far as possible the impression made upon the observer has been reproduced.

Several observers speak of a peculiar appearance of the sky at the point where the meteor first appeared.

Only two observers mention that the meteor separated into parts. These are both near the end of the flight. The phenomenon does not appear to have been sufficiently marked to attract general attention.

The point of disappearance.—Aside from the numerous hints contained in newspaper references and in inexact descriptions, four observers made records of the point of disappearance that admit of use for the purpose of computation. Thurbert H. Conklin, of Washington, D. C., makes note of the fact that the meteor apparently past behind a house in azimuth N. 50° W. and at an altitude of 5°. I am persuaded by a comparison of this observation with others that he saw the actual disappearance of the meteor. R. F. Adams, of Huntington, W. Va., records that it was last seen by him a little east of northeast. He also records that it first appeared almost directly east of his position. A glance at a map will show that this last statement can not be reconciled with the statement of those situated on the Atlantic coast. If his azimuths are corrected by 18°, both the beginning and the end of the flight are well represented. According to B. W. Adair, of Leesville, Ohio, the meteor disappeared 4° or 5° east of north. J. A. Wentz, of Canton, Ohio, reports that it past from sight at 11° south of east. This seems to be an error, however, as E. L. Vogelgesang, of the same place, reports that it came from a